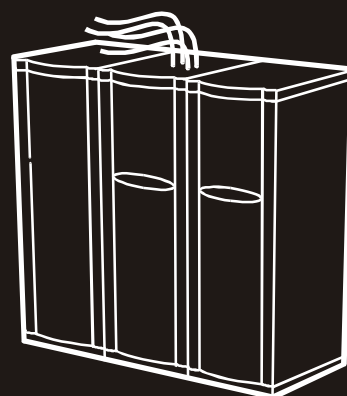




InfraStruXure™

## Installation and Start-Up

Large Data Centers  
415 and 200V Input





This manual is available in English on the enclosed CD.

本マニュアルの日本語版は同梱の CD-ROM からご覧になれます。

# About this Manual

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This manual is intended for APC Field Service Engineers or APC-trained installers of an InfraStruXure system for large data centers. It covers basic installation and start-up.

For information about installing specific components in your InfraStruXure system, see the documentation included with each component. Before installing or operating any component, refer to the safety instructions in the component's manual.

The illustrations of products in this manual may vary slightly from the products in your InfraStruXure system.



You can check for updates to this manual by clicking on the **User Manuals** link on the **Support** page of the APC website ([www.apc.com](http://www.apc.com)). In the list of InfraStruXure manuals, look for the latest letter revision (A, B, etc.) of the part number on this manual.



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# Safety

## Overview

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### Save these instructions

This manual contains important instructions that must be followed during installation, operation, and maintenance of the InfraStruXure System.

### Safety symbols used in this manual



Indicates an electrical hazard, which, if not avoided, could result in injury or death.



Indicates a hazard, which, if not avoided, could result in personal injury or damage to product or other property.



Indicates a potential hazard which could result in damage to product or other property.



Indicates important information.



Indicates a heavy load that should not be lifted without assistance.



Indicates a standby state. When in standby, the unit is not operating, but it may still contain hazardous voltage. It is not safe to service until the equipment is disconnected from all sources of electrical power.

### Cross-reference symbols used in this manual



See also

Indicates that more information is available on the same subject in a different manual.



Indicates that more information is available on the same subject in a different section of this manual.

# Warnings

---

## Installation/Maintenance

Only a certified electrician can do following:

- Connect the PDU to its power source
- Install a customer-specified, hard-wired power cable

Only a certified electrician or an APC Field Service Engineer can perform maintenance of the PDU.

When connecting the PDU to utility, a circuit breaker must be installed to protect the PDU against short-circuit current. Determine the type of circuit breaker that you need to install:

<b>Input Voltage</b>	<b>Circuit Breaker Size</b>
200 V	200 A
415 V	100 A

## Maintenance performed while the PDU is receiving input power

APC does not recommend that you perform maintenance of the PDU while it is receiving input power. However, due to the critical nature of data center loads, this may occur. If you must perform maintenance while the PDU is receiving input power, observe the following precautions to reduce the risk of electric shock:

1. Never work alone.
2. Perform the maintenance only if you are a certified electrician who is trained in the hazards of live electrical installation.
3. Know the procedure for disconnecting electricity to the PDU and the data center in case of an emergency.
4. Wear appropriate personal protective equipment.
5. Use double-insulated tools.
6. Always follow local and site regulations when working on the PDU.

## Total power off procedure

1. Set the PDU **Main Input** to **Off**.
2. Set the upstream power source circuit breaker to **Off**.

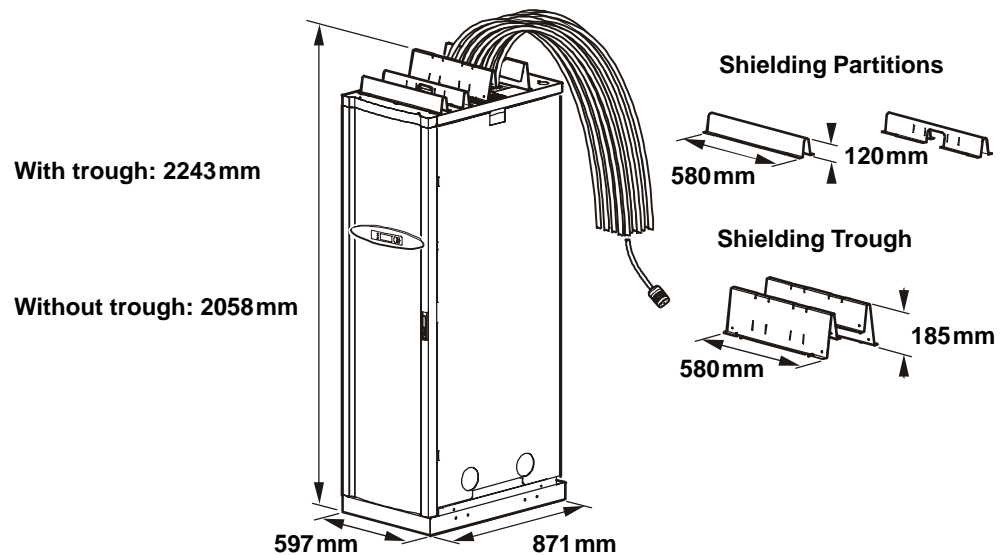
## Register equipment with the fire department

Follow local code ordinances and register all fire code-compliant equipment with the fire department.

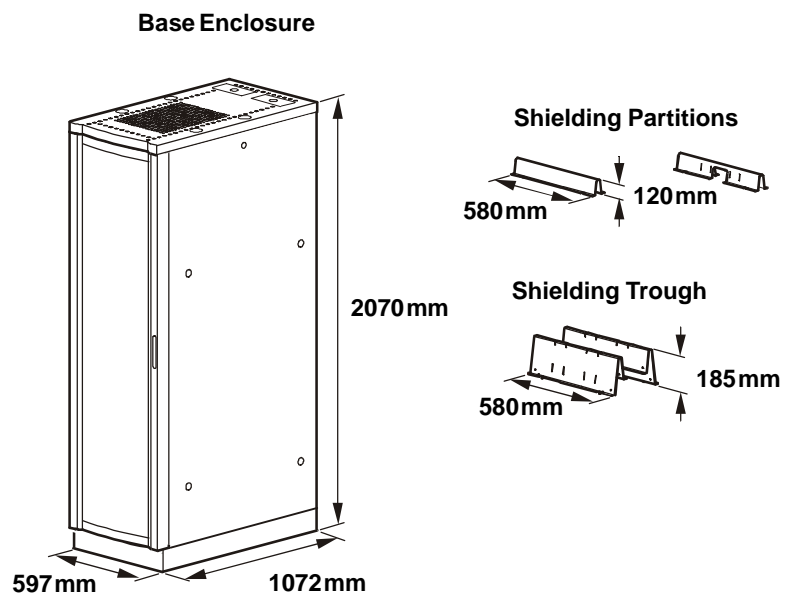
# Site Preparation

## Dimensions

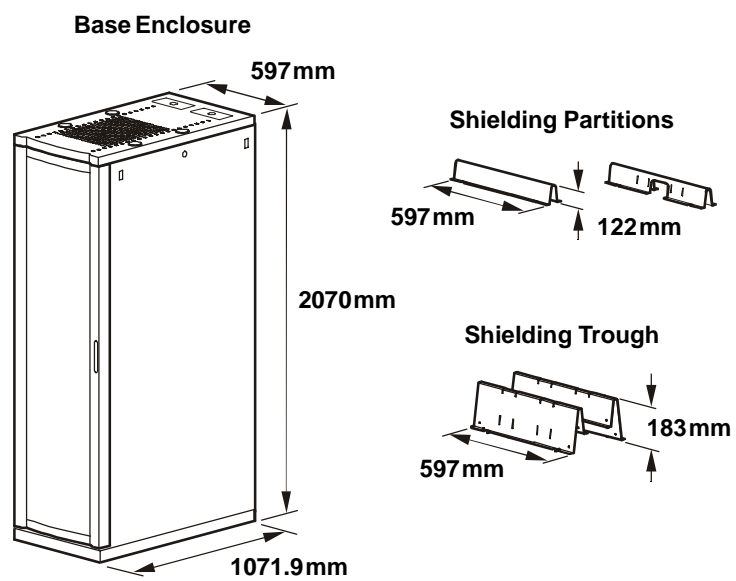
### InfraStruXure PDU



### NetShelter VX Seismic Enclosure



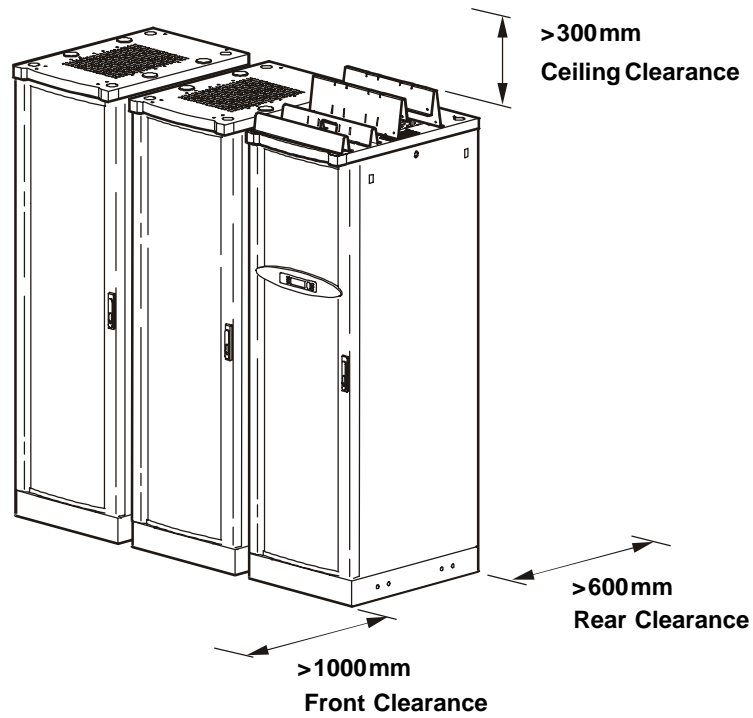
## NetShelter VX Enclosure



# Space Considerations

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Study the figures below to determine your space requirements for installing the InfraStruXure PDU, Symmetra PX UPS, and XR Battery Enclosure. Consult your local and national codes for additional requirements.



# Weight Considerations

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Use the “Maximum Packaged” weights to determine what methods you will use to move equipment into your data center.

Use the “Maximum Unpacked” weights to ensure that the floor and subfloor can support the total weight of the configuration. If you are placing equipment on a raised floor, consult the flooring manufacturer for loading requirements before installing equipment. For assistance in planning your configuration, call APC Customer Support in Japan at the number listed on the back cover of this manual.

<b>Component</b>	<b>Maximum Unpacked</b>	<b>Maximum Packaged</b>
InfraStruXure PDU	550kg	591kg
NetShelter VX Seismic Enclosure (empty)	235kg	253kg
NetShelter VX Enclosure (empty)	163kg	180kg

# Heat Output

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Consider the heat dissipation ratings of equipment to determine cooling requirements. Additional cooling equipment may be required. Heat output of the InfraStruXure PDU is shown below.

<b>InfraStruXure PDU</b>	<b>Heat Output</b>
200V input	3496 BTU/hr (1.025kW)
415V input	3746 BTU/hr (1.098kW)

# Electrical Requirements and Specifications

---

## Procedures requiring a licensed electrician



A licensed electrician must connect utility power. The following procedures require a licensed electrician:

- connection of utility conductors
- installation of a 200- or 100-amp circuit breaker
- connection to the main input switch
- connection to a branch circuit



See also

To connect utility power, see the utility connection instructions included with your documentation.

## Electrical requirements

	200 V Input	415 V Input
Service distribution breaker <sup>1,2</sup>	200 A	100 A
Conductors to Main Input switch <sup>1</sup>	3W + G	3W + G
Recommended wire sizing <sup>2,3</sup>		
L1, L2, L3	60 mm <sup>2</sup>	38 mm <sup>2</sup>
G	14 mm <sup>2</sup>	8 mm <sup>2</sup>

<sup>1</sup> Provided by customer

<sup>2</sup> Consult national and local codes for requirements specific to your installation.

<sup>3</sup> CV or CVT cable



# Basic Installation Procedure

---

This section provides the basic steps that you need to perform when installing InfraStruXure power and rack components. Follow the references provided with each step for detailed instructions.



**Do not begin installing your InfraStruXure system without an APC Field Service Engineer present.**

1. Unpack the components according to the unpacking instructions included on the outside of the packaging or in the installation manual included with the component.



Make sure that all boxes and packaging are empty before discarding them.

2. Determine the correct placement of your system components by studying your APC InfraStruXure configure-to-order (CTO) report. Move the InfraStruXure PDU and enclosures to their final location.



**If installing InfraStruXure on a raised floor, make sure that the raised-floor structure has a kg/m<sup>2</sup> rating that will support the full weight of the InfraStruXure installation. See “Weight Considerations” on page 6.**

3. Join adjacent NetShelter enclosures.



See also

For instructions on joining adjacent NetShelter VX Seismic Enclosures, see the installation manual included with your enclosures.

4. Bolt enclosures to the floor.



See page 11 for detailed instructions.

5. Ensure total power off.



See page 12 for detailed instructions.

6. Connect the power source to the PDU.

**A licensed electrician must connect the power source.**



See page 13 for detailed instructions.

7. Connect user contact inputs and output relays to the user connection plate.



See page 17 for detailed instructions.

8. Install Shielding Troughs, Shielding Partitions, and Cable Ladders.



**See also**

For instructions, see the manuals included with your Shielding Troughs, Shielding Partitions, and Cable Ladders.

9. Install the Rack Automatic Transfer Switches (ATS), Rack Power Distribution Units, and other InfraStruXure rack-mount devices.



**See also**

For instructions, see the manuals included with your Rack ATS, Rack PDU, or other InfraStruXure rack-mount device.

10. Route and attach PDU power cables to each Rack ATS and/or Rack PDU.



See page 22 for detailed instructions.

11. Route and attach communication cables to the InfraStruXure Manager hub (or switch).



See page 27 for detailed instructions.

12. Start the system.

**Only qualified, APC-trained personnel may perform a system start-up.**



See page 29 for detailed instructions.

13. Configure the InfraStruXure Manager.



**See also**

For instructions, see the manual included with your InfraStruXure Manager.

# Installation Procedures

## Join Adjacent Enclosures and Bolt Enclosures to the Floor

### Join adjacent enclosures



See also

To join NetShelter VX Enclosures, see the installation manual included with your enclosures.

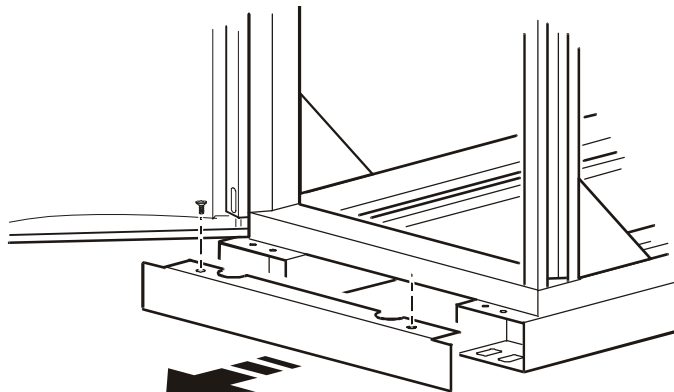
### Bolt Enclosures to the Floor



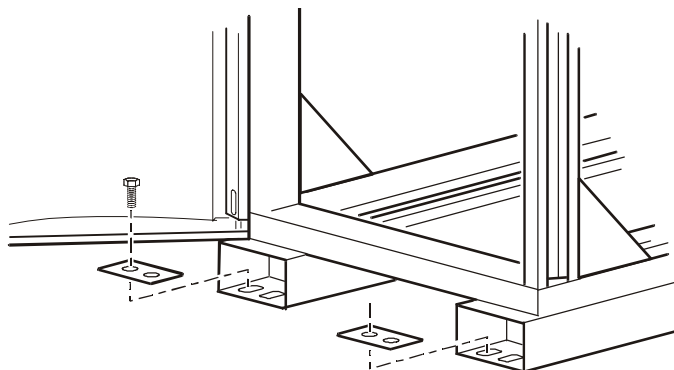
Proper anchoring hardware must be in place before starting this procedure.

To bolt the PDU and enclosures to the floor, follow these steps for each enclosure:

1. Remove the front and rear skirts on the enclosure.



2. Insert two bolts through each plate and the holes in the plinth, using the bolt plate (included). Screw the bolts into the pre-installed anchoring hardware in the floor.

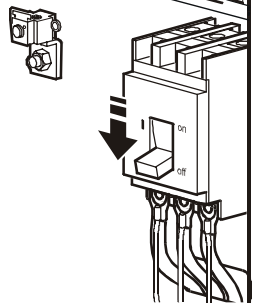


3. Tighten the bolts to 81 n·m, using a torque wrench.

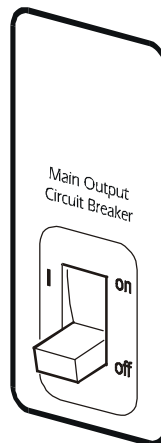
# Ensure Total Power Off

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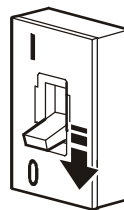
1. Set the **main input** switch on the PDU to OFF.



2. Open (turn OFF) the **main output** circuit breaker on the PDU.



3. Set the **power source** circuit breaker to OFF.

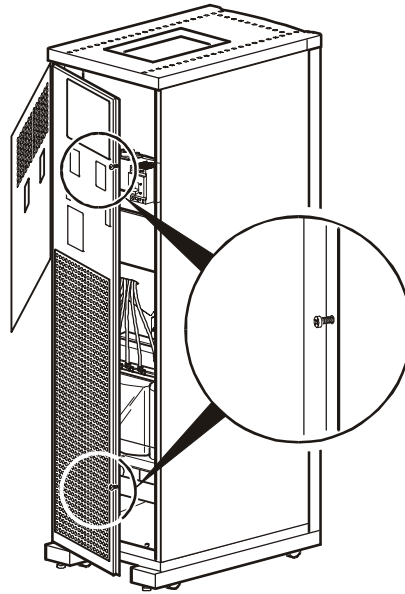


# Connect the Power Source to the PDU

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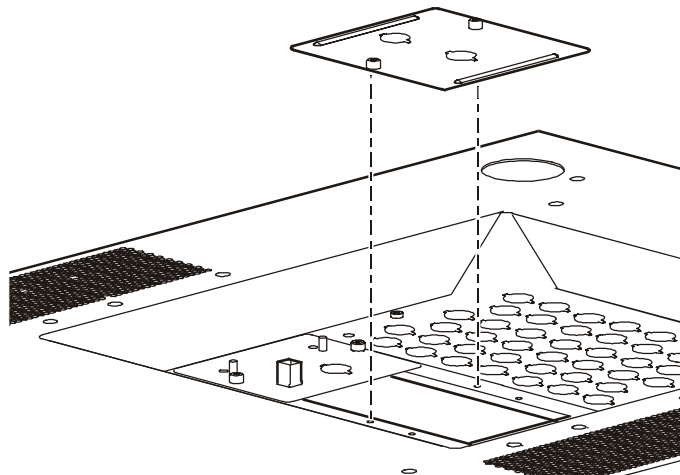
## Access the PDU Main Input switch

Open the back doors of the PDU, unlock the top, smaller door, using the provided red key. Loosen the two captive screws holding the larger, hinged door in place, using a Phillips or standard screw driver.

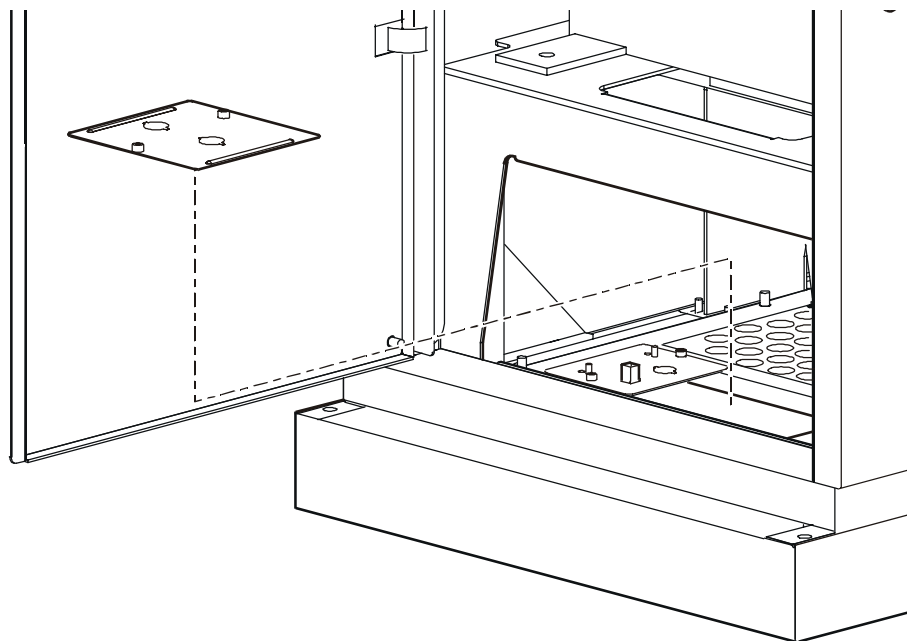


## Attach conduit to the PDU for the input conductors

1. Remove the rectangular input gland plate by loosening the captive screws, using a Phillips or standard screwdriver:
  - In the top of the PDU for overhead wiring



- In the bottom of the PDU for wiring under a raised floor

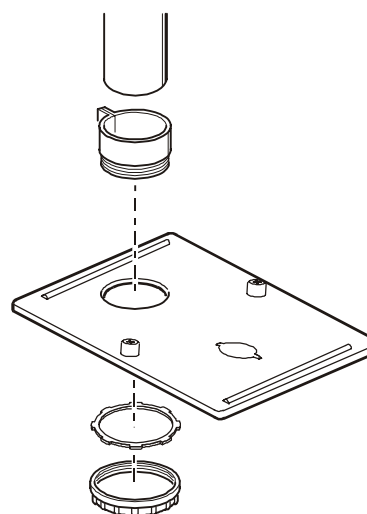


2. Create an appropriately-sized hole in the gland plate for the conduit.



The input gland plate has two knock-outs. Use either as starter hole for creating a hole for your conduit. Use a knock-out punch to create a larger hole.

3. Re-attach the gland plate.
4. Install a lock-nut and bushing to the conduit.
5. Thread the conduit through the hole.



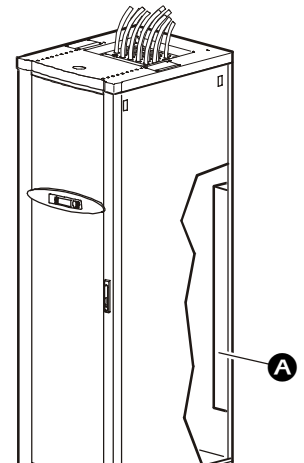
## Install a circuit breaker



**Make sure the cables used for power input are sufficiently protected by an appropriately-rated circuit breaker. See “Electrical Requirements and Specifications” on page 8.**

## Route the input conductors to the main input circuit switch

1. Route the input conductors to the main input circuit switch of the PDU, as follows:
  - For overhead wiring, run the input conductors directly to the main input switch.
  - For wiring under a raised floor, run the input conductors through the wireway (A) within the PDU to the main input switch.



## Torque specifications and tools required

Before connecting to the terminals, verify the torque specifications below by checking the specifications on the main input switch.

Terminal	Torque	Tools
L1, L2, L3	200V input: 8–13N·m 415V input: 5–7 N·m	6-mm Allen wrench #3 Plus Driver
PE	14N·m	3/16-mm Allen wrench

## Connect input conductors

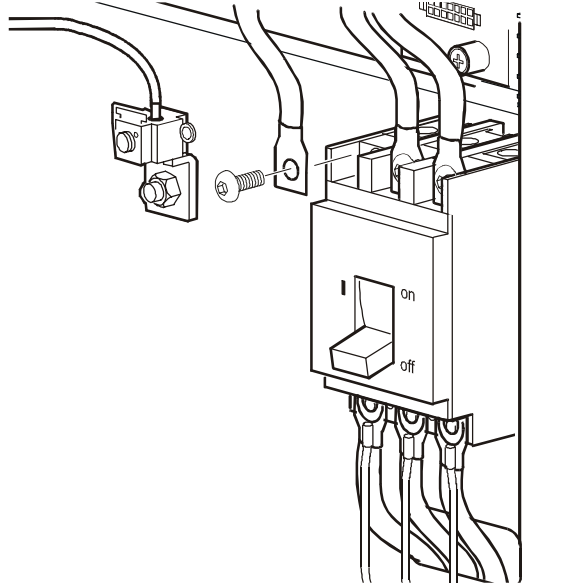


**A licensed electrician must connect input conductors to the PDU!**

At the main input switch, connect the input wiring according to the labels on the switch and the illustration on this page. See the table, “Torque specifications and tools required” on page 15 for information about connecting to each terminal.



**Connect the conductors to the terminals according to the labels on the terminals. Use copper conductors only.**




**Note:** This image is of a PDU with 200V input.





## How to connect contacts to the PDU Monitoring Unit

To connect and monitor your contacts:

1. Choose the numbers of the contacts to which you will connect.
2. From the PDU display interface:
  - a. Press the ESC or ENTER key to go to the top-level menu screen.
  - b. Select **Contacts** on the top-level menu screen and press the ENTER key.
  - c. Press the ENTER key to select the number of the contact you are connecting. The continue arrow  will appear next to the contact number.
  - d. Press the Up or Down arrow key to select the appropriate contact number and press the ENTER key.
  - e. Press the Down arrow key to enter a unique **Name** for the contact and to configure the **Normal** state of the contact (Open or Closed). The default **Normal** state is Open. Press the ENTER key to select the item you wish to configure.



You will be prompted for your password to configure these items.

3. Connect contact wires (300V-rated cabling required) to the terminal block on the user connection plate. You will need a 2.5-mm standard screwdriver.
4. Run the wires from the terminal block out the roof or under the floor of the PDU to your contact's location.



**Ensure that wires are properly retained and away from high voltage lines and breakers.**

# Install Shielding Troughs, Shielding Partitions, and Cable Ladders

---

## Shielding Troughs and Shielding Partitions for overhead wiring along rows

If you ordered APC Shielding Troughs, Shielding Partitions, and Cable Ladders to route overhead wiring for your system, assemble the Shielding Troughs and the Shielding Partitions along the rows of enclosures and assemble the Cable Ladders between rows.

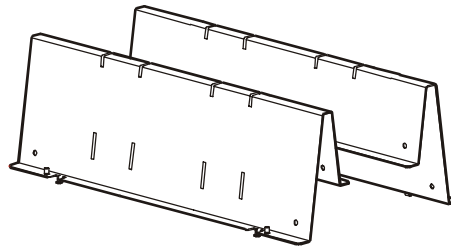


See also

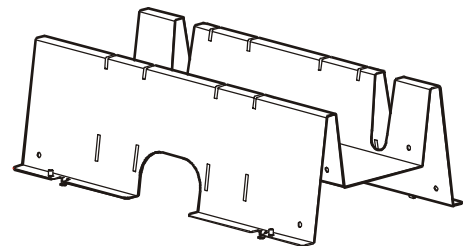
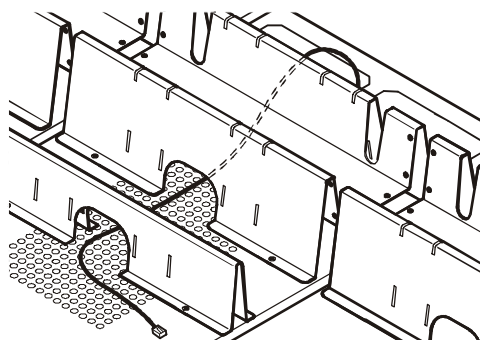
For information on grounding the Shielding Troughs and Shielding Partitions, see the instruction sheet (990-1393B) included with the Shielding Troughs and Shielding Partitions.

**Shielding Troughs.** There are two types of Shielding Troughs:

- The PDU Shielding Trough, 610mm in length, is not adjustable. The trough attaches to the top of the PDU and accommodates power cables as they exit from the roof of the PDU.



- The NetShelter Shielding Trough is 610mm in length and is not adjustable. Each Shielding Trough has an opening in each side through which you route data cables to the Shielding Partitions.

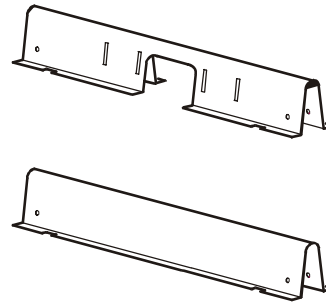


**Shielding Trough accessories.** APC offers the following accessories for Shielding troughs:

- Shielding Trough Covers for both 600-mm wide (AR8174BLK) and 750-mm wide (AR8175BLK) enclosures. Contact APC for more information.
- Shielding Trough End Caps (AR8167BLK) to place on the ends of Shielding Troughs at the end of rows. Contact APC for more information.

**Shielding Partitions.** There are two types of Shielding Partitions, each of which forms a side wall of a trough for data cables. You can customize the width of the trough for each row of your system — wider for rows carrying many data cables, narrower for rows carrying fewer.

- As the back wall, use a Shielding Partition that contains an opening for routing data cables.
- As the front wall, use a solid Shielding Partition to hide data cables for a clean appearance.



## Cable Ladders for overhead wiring across rows

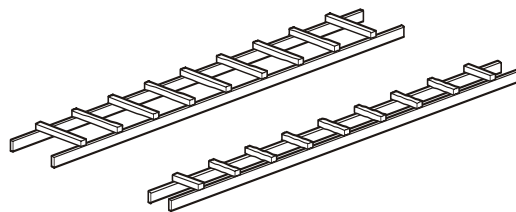
After installing the Shielding Troughs and Shielding Partitions, install the Cable Ladders between rows of enclosures. You can also run Cable Ladders across Shielding Troughs in the same row, using the hardware provided in the ladder kit.



See also

For more information on installing the Cable Ladders, see the instruction sheet included with the cable ladders (990-1576).

Use wide Cable Ladders (305 mm) where many power cables or data cables will run between rows; use narrow Cable Ladders (152 mm) where few power cables or data cables will run between rows.



The Cable Ladders are 2946 millimeters long. You can adjust the length of the Cable Ladders in the following ways:

- Cut the ends with a hacksaw to shorten them.
- Insert the connectors only partially into the side rails to extend them.



Do not change the spacing between rows or the length and position of the Cable Ladders from the layout you planned with your APC representative when you placed your order. For overhead wiring, each PDU power cable is provided at a pre-determined length. Changes to the physical configuration of your system could cause some PDU power cables to be too short or too long.

# Install InfraStruXure Rack-Mount Devices

---

## Install the Rack Automatic Transfer Switches (ATS)

Install a Rack ATS in the top of each enclosure for overhead wiring, and in the bottom of each enclosure for wiring under the floor.



See also

See the installation instructions in the manual included with your Rack ATS.

The Rack ATS is an optional component, and not all InfraStruXure systems will include it.

## Install the Rack Power Distribution Units (PDU)

Install Rack PDUs in the rear of the NetShelter VX enclosure, in the channel directly behind the rear vertical mounting rails. For overhead wiring, make sure that the power cord is pointing toward the roof of the enclosure. For wiring under the floor, make sure that the power cord is pointing toward the floor.



See also

See the installation instructions in the manual included with your Rack PDU.

The Rack PDUs is an optional component, and not all InfraStruXure systems will include it.

## Install the InfraStruXure Manager and Hub (or Switch)

Install the InfraStruXure Manager in the enclosure closest to the PDU. The CAT5 data cables included with your configuration are of varying lengths, based on the distance components will be installed from the PDU.



See also

See the installation instructions in the manual included with your InfraStruXure Manager.

## Install the APC Environmental Monitoring Unit

Install the Environmental Monitoring Unit according to the installation instructions included with the device. The Environmental Monitoring Unit is an optional component, and not all InfraStruXure systems will include it.

# Route and Attach Overhead Wiring

---

## Route and attach power cables to equipment racks

If you ordered overhead wiring, connect the prewired power cables of the PDU as follows:

1. Install the Shielding Troughs, Shielding Partitions, and Cable Ladders so that you can route power cables from the PDU to the NetShelter VX Enclosures.



See also

For installation instructions, see the manual included with your Shielding Troughs, Shielding Partitions, and Cable Ladders.

2. Find the numbers that indicate the enclosure to which each power cable will supply power. These numbers appear on the roof of the PDU where the power cables exit, and on the ends of each power cable.



The enclosures are not numbered. Consult your APC InfraStruXure Configure-To-Order (CTO) report to determine the enclosure associated with each power cable.

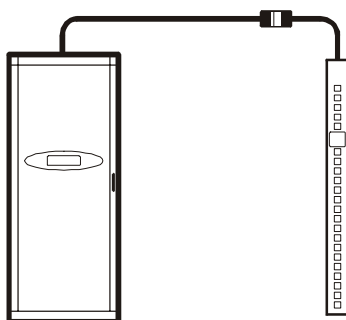
3. Beginning with the power cables for the enclosures farthest from the PDU, run each power cable within the Shielding Trough along the row and, if necessary, across one or more Cable Ladders to the enclosure to which it will provide power.



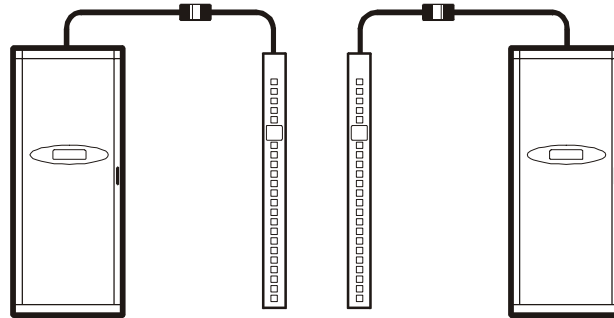
Ensure that the connector at the end of each power cable always lies on top of any longer power cables in the Shielding Trough.

4. Connect the appropriate power cable to APC power management equipment in the enclosure in one of the four following ways:

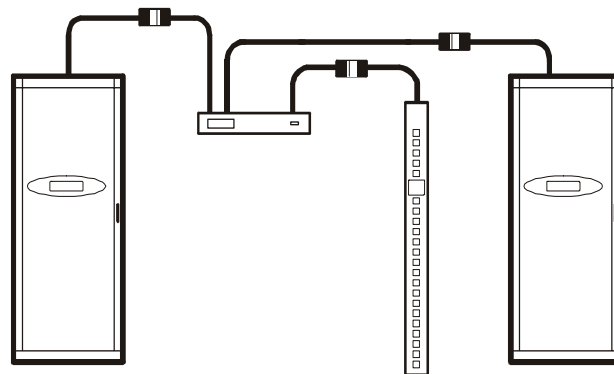
- *For single-feed devices without redundancy:* attach a power cable directly to a Rack PDU installed in a NetShelter VX Enclosure.



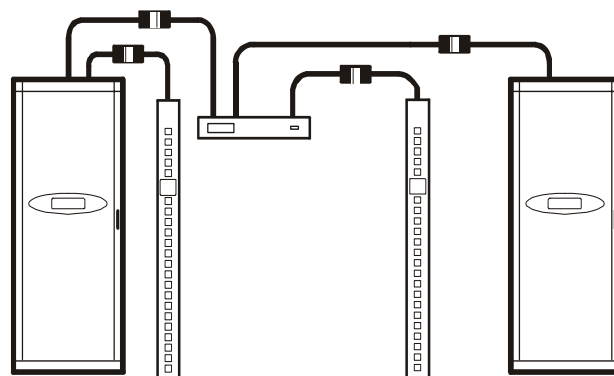
- *For dual-feed devices within a redundant system:* attach a power cable from each PDU into two different Rack PDUs in the NetShelter VX Enclosure.



- *For single-feed devices within a redundant system with an Automatic Transfer Switch:* connect a power cable to the Automatic Transfer Switch (A and B feeds) and connect the Automatic Transfer Switch power cord to a Rack PDU in the NetShelter VX Enclosure.

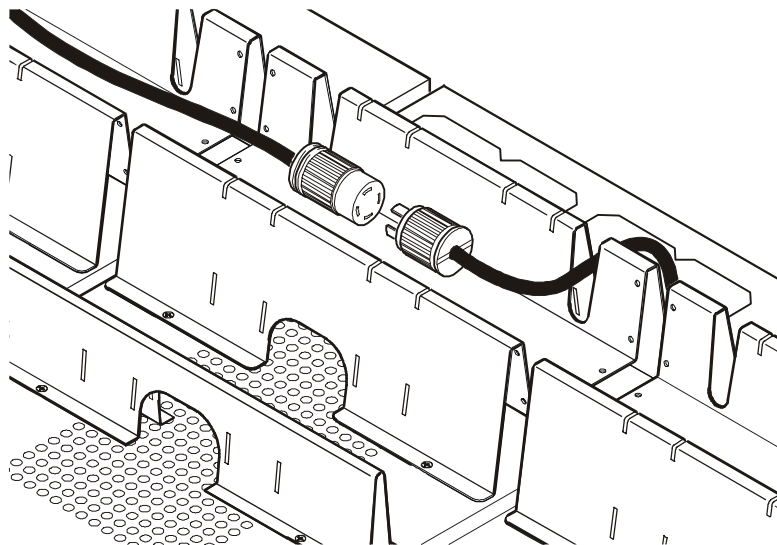


- *For dual-feed devices in a redundant system with an Automatic Transfer Switch:* connect a power cable from each PDU to the Automatic Transfer Switch's A and B feeds, and another power cable from one PDU to a Rack PDU, and the Automatic Transfer Switch's power cord to a second Rack PDU in the NetShelter VX Enclosure.



Lay the cables neatly in the Shielding Trough to minimize cable build-up.

5. From each NetShelter VX Enclosure, run the power cable of the appropriate APC power management device out the roof of the enclosure, through the notch in the rear side of the Shielding Trough, to the connector of the appropriate power cable from the PDU. Plug the two connectors together, and twist them clockwise to lock.





# Wiring Under the Floor (Alternative)

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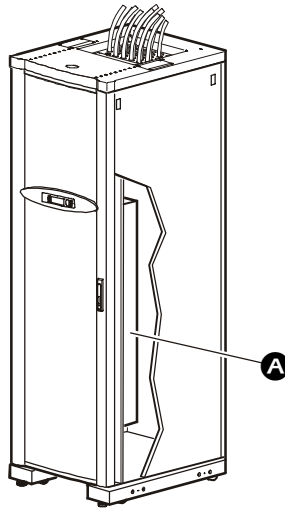
**A licensed electrician must route and connect the power cables for wiring under the floor.**



**Make sure all wire connections and circuit breaker connections are properly torqued.**

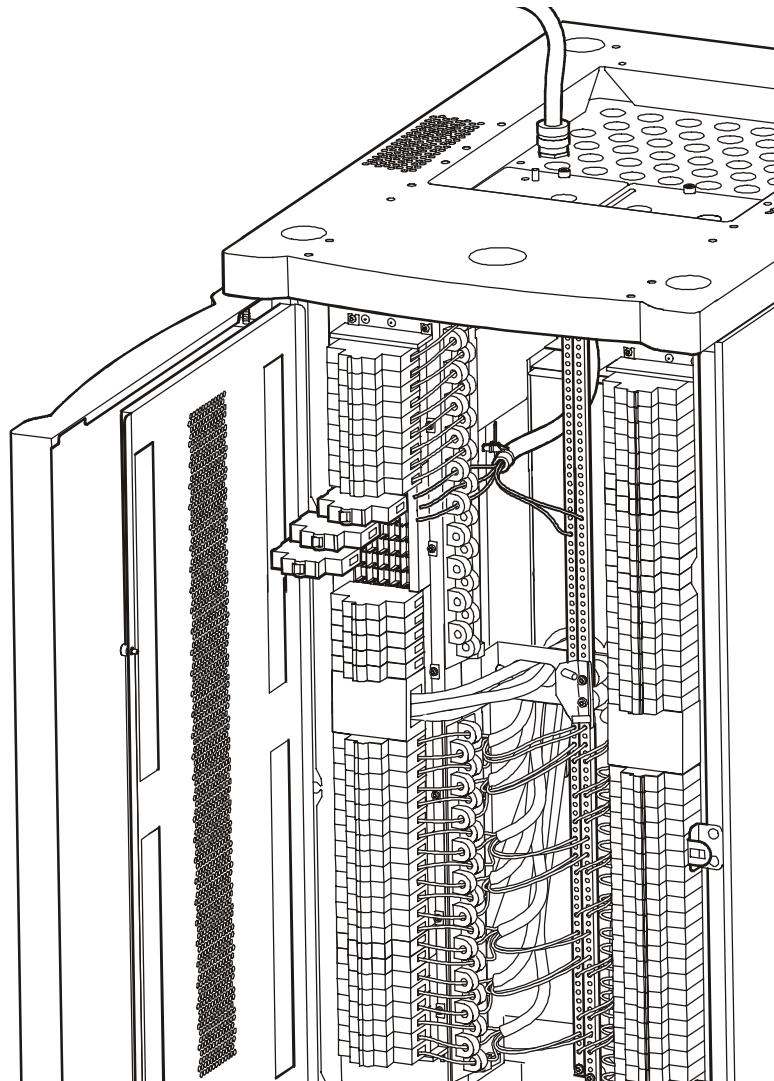
If you are routing power cables under a raised floor to the enclosures, you must provide the appropriate power cables and equipment for installation, and a licensed electrician must route and connect the power cables to the PDU circuit breakers. To wire each power cable to an enclosure:

1. Push out a knock-out filler in the floor of the PDU to create an opening for the cable.
2. From the Rack PDU or Rack ATS in each enclosure, thread the appropriate power cable (for your application) from the enclosure to the PDU.
3. At the PDU, route the cable through the opening you created in step 1 and then up through the wireway (A) at either side of the PDU. This will allow you to connect the cable to the upper circuit breaker panel.



4. At the circuit breaker panel, cut the wires to the proper length, and connect the power cable's individual wires:

- a. If you have branch current monitoring installed, route each phase conductor through a current sensor. If it is a multi-circuit cable, route the L1, L2, and L3 wires through separate current sensors.
- b. Connect the L1, L2, and L3 wires to the circuit breaker(s). The illustration at right shows a single-circuit cable connecting to a single-pole breaker; however, you can also connect a multi-circuit cable to a four-pole breaker.



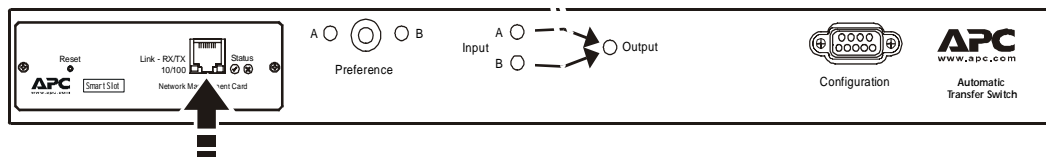
- c. Connect the neutral wire to the closest open termination point on the Neutral Bar.
  - d. Connect the PE wire to the closest open termination point on the PE Bar.
5. Connect the neutral wire to the neutral bar and the PE wire to the isolated ground bar.

# Route Data Cables to the InfraStruXure Manager Hub (or Switch)

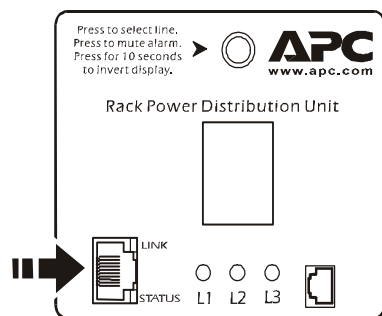
## Connect network cables to InfraStruXure components

Connect a Cat5 network cable (provided) to the network or 10Base-T port on each of your APC InfraStruXure devices. The following devices need to be connected:

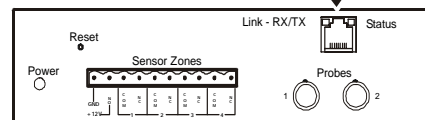
### Automatic Transfer Switch



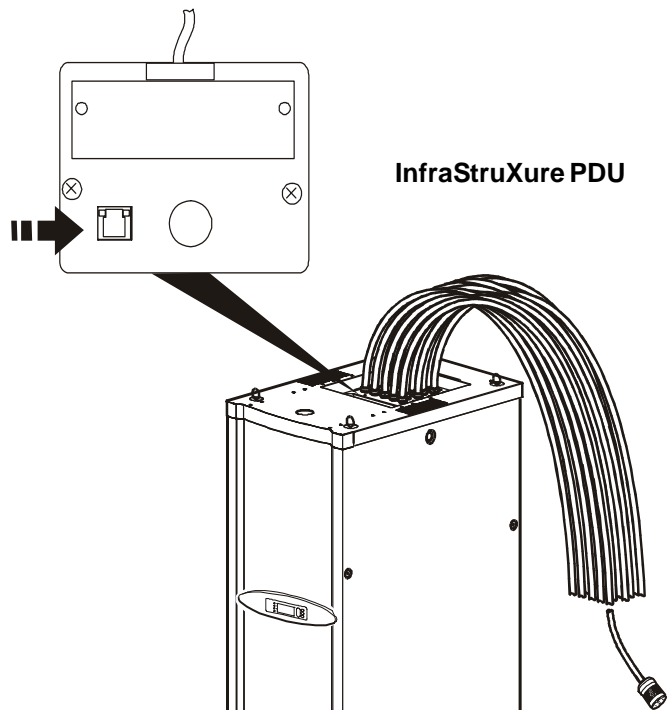
### Rack PDU



### Environmental Monitoring Unit



### InfraStruXure PDU



## **Route network cables to the InfraStruXure Manager hub (or switch)**

### **Overhead routing.**

1. Install Shielding Partitions and Cable Ladders.



See “Install Shielding Troughs, Shielding Partitions, and Cable Ladders” on page 19.

2. Run the Cat-5 network cables (provided) from each APC device to the InfraStruXure Manager hub (or switch).
  - a. Start with the device farthest from the enclosure housing the InfraStruXure Manager and hub (or switch), and use the longest supplied Cat-5 cable.
  - b. Bundle cables together and run the bundles in the data cable troughs along rows and across Cable Ladders, if necessary.
3. Connect each APC device’s network cable to any available station port in the InfraStruXure Manager hub (or switch). Station ports are those with an *x* after the number (e.g., 2x).



**See also**

After you have connected the components to the hub, connect the InfraStruXure Manager to the hub. For instructions, see the manual included with your InfraStruXure Manager.

# Start-Up Procedure

## Safety warnings



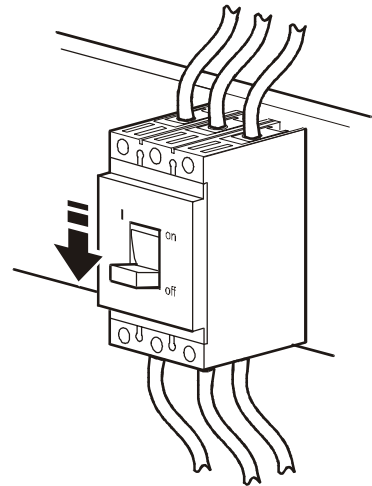
Only APC Field Service Engineers or qualified, APC-trained personnel may perform a system start-up.



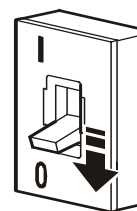
Before you proceed, ensure that power is off by following the procedure in this section.

## Ensure that all power is off

1. Open (turn OFF) the PDU **main input**.

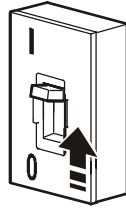


2. Set the upstream input circuit breaker (utility or UPS) to the OFF or Locked Out position.

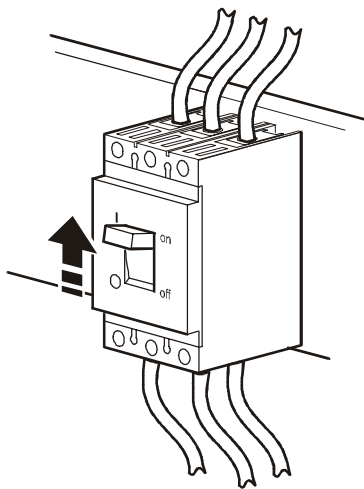


## Apply power to the system

1. Set the upstream input circuit breaker (utility or UPS) to ON.

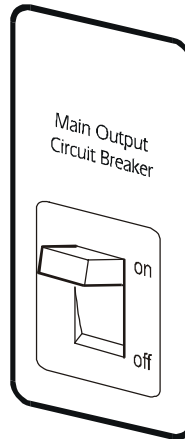


2. Ensure R-S-T clockwise phase rotation at the top of the **main input** switch on the PDU, using a phase rotation meter.
3. Close (turn ON) the **main input** switch on the PDU.



4. Verify R-S-T clockwise phase rotation at the top of the primary winding of the transformer, using a phase rotation meter.
5. Verify that the proper voltage is present on the secondary winding of the transformer (200 or 173 V, metered phase-to-phase), using a true RMS voltmeter.

6. Close (turn ON) the **Main Output** circuit breaker on the PDU.



When the **Main Output** circuit breaker is closed, the power distribution circuit breaker panels are energized.

7. Close (turn ON) the PDU **distribution panel** circuit breakers.



When the **distribution panel** circuit breakers are closed, the PDU power cables and connected equipment are energized.





# Configuration

## Configure the InfraStruXure Manager

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After you complete the installation and system start-up, configure the InfraStruXure Manager.



See also

For instructions, see the manual included with your InfraStruXure Manager.



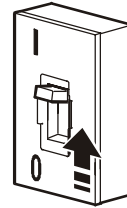
If you use PowerChute Network Shutdown (PCNS) software with your InfraStruXure UPS, your UPS must have a connection to the “User LAN” (public network) for PCNS to function correctly. If the Network Management Card installed in your UPS is connected to the InfraStruXure Manager’s “APC LAN,” you must install a second Network Management Card in your UPS and connect it to the “User LAN” (public network) to use PCNS.



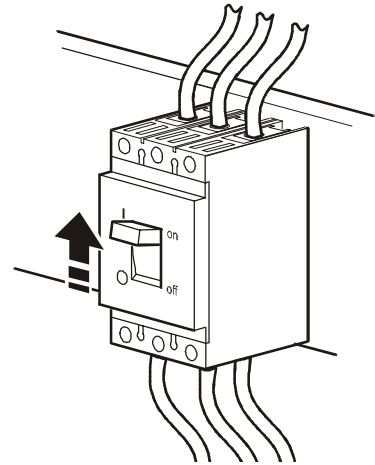
# Appendix A—System Operation

## How to Apply Power to the System

1. Close (turn ON) the main circuit breaker of the **power source** supplying power to the PDU.

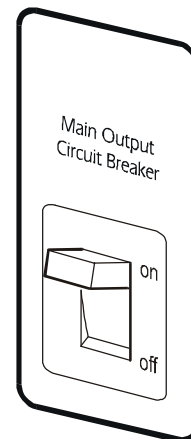


2. Close (turn ON) the **main input** on the PDU.



3. Power the PDU distribution circuit breakers.
  - a. Set the **Main Output** circuit breaker on the PDU to ON.

**Note:** After the **Main Output** circuit breaker has been closed, both PDU distribution panels will be energized.



- b. Close (turn ON) the PDU **distribution panel** circuit breakers.

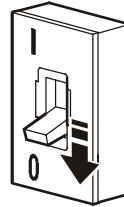


When the **distribution panel** circuit breakers are closed, the PDU power cables and connected equipment are energized.

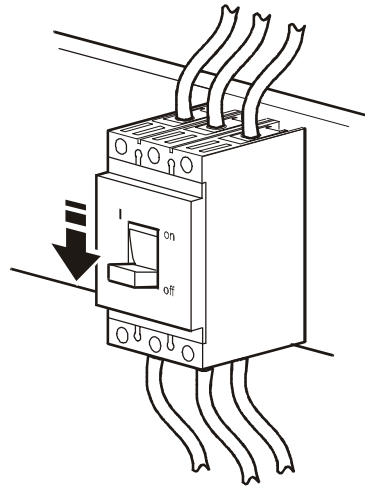
# How to Ensure Total Power Off

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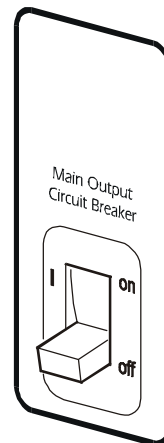
1. Open (turn OFF) the main circuit breaker on the **power source** feeding the PDU.



2. Open (turn OFF) the **main input** switch on the PDU.



3. Set the **Main Output** circuit breaker on the front of the PDU to OFF.







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- Contact an APC Customer Support center by telephone or e-mail.
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